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Impact and Spillover Effects of an Asset Transfer Programme on Malnutrition

Evidence from a Randomised Control Trial in Bangladesh

Wameq A Raza
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Editing
Iftekhar A Chaudhury

Printing and publication
Altamas Pasha

Cover design
Sajedur Rahman

Layout design
Md Abdur Razzaque

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# ABSTRACT

Evidence shows that ultra-poor households are typically unable to participate in mainstream poverty alleviation programmes. In response, an international NGO called BRAC in Bangladesh implemented the Challenging the Frontiers of Poverty Reduction: Targeted Ultra-Poor (CFPR: TUP) programme that explicitly targets those living below \$0.60-\$0.70/day. The innovative scheme combines the provision of income generating assets with an integrated approach that includes multifaceted training on entrepreneurial activities, health, nutrition, social and political awareness training over a period of two years. A number of papers have established the positive impact of the programme on various socioeconomic indicators of participants and the positive spill overs to non-participants. This is the first paper to evaluate the effects of CFPR on nutritional outcomes using data from a randomised control trial covering 26997 households and panel data over a four year period. We find large improvements in nutritional outcomes among household members who participate in CFPR. The impact is most notable for children under 5 where the likelihood of wasting reduces by 8 percentage points (pp) and the likelihood of being underweight by 19 pp. Behavioural changes, such as increased duration of exclusive breastfeeding, administration of vitamin A appear to be the primary drivers of nutritional improvements for children; while food security and hygiene practices are important pathways for improvements in adults' nutritional status. Spill over effects on non-participants are generally half the size of the main effect, and are only found for poor non-participants suggesting that behavioural changes are more likely to be adopted by groups of similar socioeconomic status. Overall, we conclude that asset transfer programmes such as the CFPR can have large positive long term health effects and lead to positive externalities.

Word count: 6514

Keywords: RCT, impact, spill-over, nutrition, ultra-poverty, Bangladesh JEL classification codes: I13, I320

Highlights:

- CFPR participation positively impacts the nutritional status of households members
- Spill over effects are about half the size of the effects on participants
- Impact is most notable for children, both for the treatment and spill over effect
- Exposure to CFPR's messages cause lasting positive behavioural change

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INTRODUCTION

Extreme poverty is widespread and persistent in Bangladesh with more than a third of the population living under $ 1.25/day. In response, Challenging the Frontiers of Poverty Reduction (CFPR) programme was launched by BRAC. The programme provides income generating assets, multifaceted training on entrepreneurial activities, health, nutrition, social and legal awareness over a period of two years with the aim of merging them with the mainstream poor.[1] A number of studies have investigated the effects of CFPR on the programme's main intended outcomes such as income, asset holdings and occupation. They report strong positive short and long run impact of participation on income, productive asset holdings during the first phase of the programme using quasi-experimental methods (CFPR I: 2002-2006) (Emran *et al*. 2014; Misha *et al*. 2014; Prakash and Rana, 2006; Raza *et al*. 2012).[2] The second phase of the programme (CFPR II: 2007-2011) uses a randomised control trial (RCT) design to generate robust evidence on impact as well as its spill over effects.[3] Results derived from this phase of the programme are comparable to the first (Bandiera *et al.* 2013; Das *et al.* 2009). Bandiera, Burgess *et al*. (2012) is the only study to report on the avenues and magnitudes of the spill over effects of CFPR II at the community level. The programme has received wide acclaim and is being replicated across 20 countries.[4]

To the best of our knowledge, there is no evidence on the programme's impact on secondary outcomes like malnutrition. While beneficiaries were given information on healthy lifestyles and good nutrition, especially for children, there were no transfers

1 BRAC considers individuals earning USD $0.60 - $0.70 per day to be ultra-poor (BRAC, 2013).

2 Income in the short run for example experienced a 56% increase over the baseline. While the difference continued to increase over the mid-run, it stagnates in the long term driven mostly by the catch-up among the control group (33% over the baseline) (Misha *et al*. 2014). For other outcomes such as food intake, Haseen and Sulaiman (2007) find that programme participation led to both an increase in mean calorie intake from 1750 to 2138 per day, and in the quality of the calories consumed.

3 CFPR I reached approximately 100,000 households while CFPR II was scaled up to encompass nearly 800,000 households.

4 Banerjee *et al.* (2015) perform RCTs across six of these locations and find that driven by the rise in income, the programme produces significant and cost-effective impact on consumption and improves the psychological conditioning of the participants.

in terms of food. Establishing the effects of such an anti-poverty programmes on malnutrition is important, especially given the relatively high and persistent malnutrition rates in the country. Malnutrition is a major contributor to child morbidity and mortality in Bangladesh (Rahman *et al*. 2009).[5] Nearly 39% of children younger than 5 in rural Bangladesh are underweight while 28% of women report thinness (body mass index [BMI]<18.5) (National Institute of Population Research and Training (NIPORT) *et al*. 2013).[6] Inadequate nutrition increases the probability of contacting infectious diseases, stifles cognitive development and leads to growth faltering for children under 5 (Black *et al.* 2008; Haddad, 2003; Venis, 2003; World Health Organization, 2013). Malnourished adults are susceptible to chronic illnesses such as high blood pressure, diabetes and heart diseases while economic costs can add up to 10% of lifetime earnings (Horton and Steckel, 2013; Hunt, 2005; Saunders and Smith, 2010). Further discussion of the consequences of malnourishment are available in Isabel and Correla *et al*. (2003).

Malnutrition is largely driven by poor maternal and child care practices, food insecurity and unsafe public health conditions (Gartner *et al.* 2005; World Health Organization, 2013). Exclusive breastfeeding plays a crucial role in determining early childhood nutrition status. In Bangladesh, while nearly all mothers initiate breastfeeding soon after birth, the average duration of exclusive feeding however is 3.5 months, which is below the recommended WHO average of 6 months. Infectious diseases such as diarrhoea, malaria, pneumonia, and acute respiratory illnesses among children can diminish the absorptive capacities of vital nutrients leading to malnutrition and remains a major cause of morbidity (Brown 2003). Though the prevalence of such diseases have dramatically reduced over the past decade and are now responsible for only 2 per cent of under-5 deaths, the rate remains at 49 (per 1000 live births) despite the 50% decline over the past two decades. Nearly 99% of the rural population in Bangladesh has access to improved sources of drinking water such as a piped water source, tube wells or protected springs. The use of safe sanitary facility such as with a running flush, pit latrine and composting toilet is however restricted to only a third of the rural population (National Institute of Population Research and Training (NIPORT) *et al.* 2013). Though not considered the primary focus of CFPR, the health component of the programme targeting the aforementioned pathways could be expected to impact nutritional outcomes. In addition to facilitating access to sanitary facilities to the participants, the CFPR raised awareness on healthy behaviours (breastfeeding, handwashing), and provided participants with easier access to primary health care.

5 Nearly 37% of children under 5 are undernourished worldwide, the highest concentrations in South Asia and Africa (UNICEF, 2012).

6 Indication of long term malnutrition (stunting) for example in Bangladesh and Nepal are 41% compared to 44% in Pakistan and 48% in India. (Chowdhury *et al*. 2013; UNICEF, 2013).

The health impact of CFPR is likely to extend to non-participants living in the targeted districts, either through economic spill-overs as identified in previous research (Bandiera *et al*. 2013), or through behavioural factors such as prolonged breastfeeding and increased hygiene practices. A considerable number of studies have drawn attention to the spill-over effects of anti-poverty programmes. PROGRESA (later renamed Oportunidades), a conditional cash transfer programme targeted at poor Mexican households, was found to have substantial impact on consumption of food and non-food items, asset ownership and increased schooling. Important spillover effects of PROGSESA have been identified on consumption[7] (Angelucci and De Giorgi 2006), asset ownership (Barrientos and Sabatés-Wheeler 2011), schooling (Bobonis and Finan, 2002) and preventive care (Bouckaert 2014).

This study uses a two wave panel dataset from a randomly rolled out CFPRII programme across 13 of the poorest districts in Bangladesh. We first evaluate the impact of the CFPR on the nutritional status of participant household members, and subsequently investigate spill over effects on non-participants. We distinguish between spill-over effects on the poor and non-poor. As gender inequality is high on the policy agenda in Bangladesh and the impact of anti-poverty programmes has been linked to the gender of the main recipients (Berger 1989), we investigate the heterogeneity of impact across sex of the household head and the sex of the household member. Lastly, we identify potential pathways of both the main effects and spill-over effects. This paper adds to several strands of the literature. It is the first paper to look at the nutritional impact of such a large scale ultra-poverty alleviation programme. Second, it adds to the understanding and pathways of spill-over effects on non-beneficiaries of such programmes.

In the next section, we first describe the CFPR programme. This is followed by a description of the dataset and identification strategy. Thereafter, results are presented and discussed, after which concluding remarks and policy recommendations are made.

7 Magnitudes of effects on the non-treated are typically a third of the average treatment effects when it comes to consumption and more than a fifth for asset holdings (land and livestock). Magnitudes of spill-over effects for preventative care varies between 12% and 80% of the main impact across outcomes.

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CFPR PROGRAMME AND PATHWAYS OF SPILLOVER EFFECTS

Evidence shows that NGOs traditionally find it challenging to reach the ultra-poor for various interventions as they typically lack the skills and the means to participate in such programmes (Hashemi and Rosenberg 2006; Navajas *et al.* 2000). To explicitly reach this elusive population, the CFPR uses a three-step targeting procedure. Geographic selection, based on the World Food Programme poverty map, is first carried out to identify the poorest *upazilas* (sub-districts) of the country. Post-selection, BRAC officials from these *upazilas* scope their respective areas and identify the most vulnerable areas within the communities. The last step combines the use of wealth ranking exercises (WRE) (see Participatory Rural Appraisal for details (Chambers, 1994)) and surveys in each of the communities to identify ultra poor households. All households within each of the communities are then divided into 5 to 6 relative wealth ranks. Households in the bottom rank are considered the poorest and are subject to verification surveys to ensure eligibility.[8]

CFPR eases the innate restrictions of a resource and skill poor household through the provision of income generating assets[9] valued at approximately USD 140 and a comprehensive livelihood development training programme to encourage entrepreneurship. Once selected, the participants enrol in the programme for two years. During this time, in addition to regular hands on training in maintaining the assets and developing entrepreneurial skills, the participants develop skills in education, social and political awareness, health and nutrition through bi-weekly training sessions with a BRAC programme official. The households in addition receive a small weekly sustenance allowance during the first year to counter potential opportunity costs.

8 The inclusion criteria include (3 of 5 have to be met): Household owns less than 10 decimals of land; Main source of income is by female member begging or working as domestic help; no active male adult (female household head); School-aged children working for pay; No productive or income generating assets. The exclusion criteria, of which all have to be met, include: No Active female member in the household; Microfinance participants; Household members receiving government benefits such as old age pensions.

9 These assets typically comprise of some combination of cows, goats, poultry or vegetation nurseries that best suited for the capacity of the participant and local conditions such as access to grazing grounds.

Association with CFPR grants the participants access to the Essential Health Care package that includes health and nutrition education covering topics such as importance of exclusively breastfeeding until the 6th month, child immunisation, pregnancy care, oral rehydration therapy, provision of basic curative care for common illnesses at cost, or free if the patient is unable to pay and the delivery of DOTS (Directly Observed Treatment, Short course) for tuberculosis patients. The rationale behind these components is to develop health awareness, change "unfelt need" to "felt need" and control disease transmission. All training sessions are done on a one-to-one basis, usually within the confines of the participant's home.

The CFPR creates an influx of agricultural assets in the treated communities, precipitates a shift in the hours devoted from wage to self-employment among the poorest women in the community and increases self-employment output (e.g. milk, eggs) in the local markets. Bandiera *et al*. (2012) purport this causes spill-over effects in local wages, output and livestock prices, leading to changes in the local market equilibrium.The spill-over effects studied in this paper are more behavioural in nature and we hypothesise pathways through which these may occur. As the CFPR revolves around repeated dissemination of messages through in-depth and repeated training sessions on various topics to ensure information retention. Social networks and the "word of mouth" are quite fluid in rural communities and information is transmitted through households within similar socioeconomic strata (Banerjee *et al*. 2013; Scott, 2012). The importance of the knowledge gained through interventions results in explicit or implicit signalling by participants and its subsequent effects can instigate "demonstration effects" among non-participating households (Handa *et al*. 2001; Miguel and Kremer 2004). While non-participant households do not receive direct transfers of goods, services or knowledge, information on nutrition, health and overall well-being acquired by participants are easily transmitted among neighbours. As a proxy for these pathways, we investigate the effects on intermediary outcomes among the non-participants.

DATA AND METHODS

EVALUATION DESIGN AND DATA COLLECTION

The data for the study was collected from 40 BRAC field level branches encompassing 13 of the poorest districts in Bangladesh.[10] Once the decision was reached as to which branches within the districts would receive the intervention, the evaluation team randomly selected 20 *upazilas* with at least two branches. Using pair-wise randomisation, each was randomly assigned as treated or control branch. Each of the branch offices within the *upazilas* typically operate within a 5 km radius while the branches on average are 12 km apart.

Prior to the randomised assignment to treatment or control, wealth ranking exercises were carried out in each branch and final selections were made. To prevent anticipation effects, none of the surveyed households in either the treated or control area was aware of the CFPR at baseline. The control groups were oblivious to its existence until 2011, at which point they also were enrolled. Three groups of people were surveyed in each of the locations: (i) the ultra-poor (UP), (ii) the other-poor (OP), that is, those who were primarily selected during the WRE but later disqualified during the verification surveys and (iii) the non-poor (NP).The average treatment effects on the treated are identified by comparing the UP across treated and control communities. Spill-over effects are derived through the comparison between OP and the NP individuals across treated and control districts.

Pre-intervention data from 2007 amasses information from 23,417 individuals (7,817 households) from UP households, 43,575 individuals (12,551 households) from OP households and 28,345 individuals (6,609 households) from NP households in treated and control areas.[11] Attrition over the course of four years (17%, 16% and 15% respectively among UP, OP and NP households) led to a balanced panel of 19,427 individuals in UP households, 36,476 members in OP households and 24,096 individuals in 2009. The primary respondent was the main female member of

10 Baseline survey branches were from 13 districts (Chapainobabganj, Kishorganj, Madaripur, Naogaon, Netrokona, Sherajganj, Thakurgaon, Ponchogorh, Nilphamari, Lalmonirhat, Kurigram, Gaibandha and Rangpur).

11 See Table 2 for age-specific sample sizes.

the household. All surveys were conducted between April and December in each of the respective years. Further details are available in Table 1.

Table 1. Sample

Category	Baseline sample (individuals [households])	Additions†	Attrition	Balanced panel (individuals)
Ultra poor	23417 [7817]	4187	3990	19427
Other poor	43575 [12551]	7824	7099	36476
Non poor	28345 [6609]	5984	4258	24096

Notes: Table shows sample details of population groups.†Individuals added on to households within the groups by the way of marriages or births.

VARIABLES

Survey instruments collected information on height, weight, sex and age (in months for individuals under 5, in years for above) on all members of the household.[12] We categorise our sample following the WHO reference population guidelines: 0 to 5 years; 6 to 19 years and 19+ years.

Anthropometric outcomes for children (under 5) are calculated using the WHO 2006 growth standards (Borghi *et al.* 2006). We calculate height-for-weight (WHZ), weight-for-age (WAZ) and height for age (HAZ) z-scores (de Onis *et al*. 2007; World Health Organization, n.d.) and consider children with z-scores below -2 standard deviations (SD) from the median of the reference population as respectively wasted, underweight and stunted (World Health Organization 2010). Wasting indicates acute malnutrition, stunting reflects chronic malnutrition and underweight a combination of both acute and long term malnutrition (Borghi *et al*. 2006; Group 1986; World Health Organization, 2010). Following the WHO recommendation, for the 6-19 years age group we use body mass index (BMI) z-scores, and an indicator of thinness (z-score below -2SD) instead of the WHZ z-score and binary indicator. For adults older than 19 we use continuous BMI as a measure of nutritional status, and indicators of moderate and severe thinness defined as BMI below 18.5 and 17 respectively (Garrow and Webster 1985; NIPORT 2013).

We follow the UNICEF (1990) nutrition framework to identify the most important determinants of nutritional status. The framework suggests insufficient breastfeeding, vitamin A and iron deficiencies among infants and children contribute to a low nutrition status. Infectious diseases such as diarrhoea, malaria, pneumonia and acute respiratory illnesses among children can diminish the absorption capacities of vital

12 Recumbent supine length was collected for children under 24 months of age.

nutrients leading to malnutrition (Brown 2003). For adults, the framework suggests the combined effects of food insecurity, ill health and poor public health conditions culminat, in malnutrition. Using this framework as a guide, we assess the impact of CFPR on a number of intermediary outcomes that are hypothesised to affect the nutritional status of members in participant and non-participant households: initiation and duration of exclusive breastfeeding[13], vitamin A supplementation (for children aged between 6 to 59 months) and disease prevalence in the15 days preceding the survey. For children, information is collected on symptoms reflecting diarrhoea, malaria, pneumonia and acute respiratory illness, while for adults we use an indicator for any illness. General attributes of the household included whether the household has access to sanitary latrines and safe drinking water.

BASELINE CHARACTERISTICS

Table 2 shows baseline means of outcomes of interest across the various groups. Columns 1 and 2 show means of individuals in UP households in treated and control areas followed by their normalised differences in Column 3. Normalised differences are calculated as the difference in means divided by the square root of the sum of their variances. Imbens and Wooldridge (2009) proposed this scale free measure as an alternative to using t-tests that increase mechanically with sample sizes. Authors suggest that only normalised differences above 0.25 are likely to be sensitive to specification changes. Columns 4 and 5 show outcome means across treated and control areas for individuals in OP households followed by their scale-free differences in Column 6. Outcomes appear to not significantly differ across treated and control areas among all age groups, suggesting that randomisation was successful in creating similar groups. We generally expect members in OP households to be less malnourished given their higher socioeconomic status.

Nutritional status indicators for children below 5 are graphically represented in Fig 1 (see Annex A1 for details). At baseline approximately a fifth all children are wasted, nearly half are stunted and underweight across the treated and control areas for UP and OP households. Similarly, continuous z-scores indicating malnutrition (weight-for-height, height-for-age and weight-for-age) are considerably below the WHO reference median across all groups.

Panel-A in Table 2 show corresponding baseline averages for the 6 to 19 years population, indicating similar degrees of malnutrition (see Table 2). While nearly a quarter of the sample across all groups are moderate to severely thin, nearly 40% are stunted. Panel-B of Table 2 shows means of the BMI for adults and the likelihood of moderate and severe thinness. Trends show that nearly 2/3rd of the adults are moderately thin while a third are severely thin (summary statistics in 2011 are presented in Annex A3).

13 The information was collected in days for less than one month and the number of months thereafter. For this study we convert the months to days by multiplying the number by 30.42.

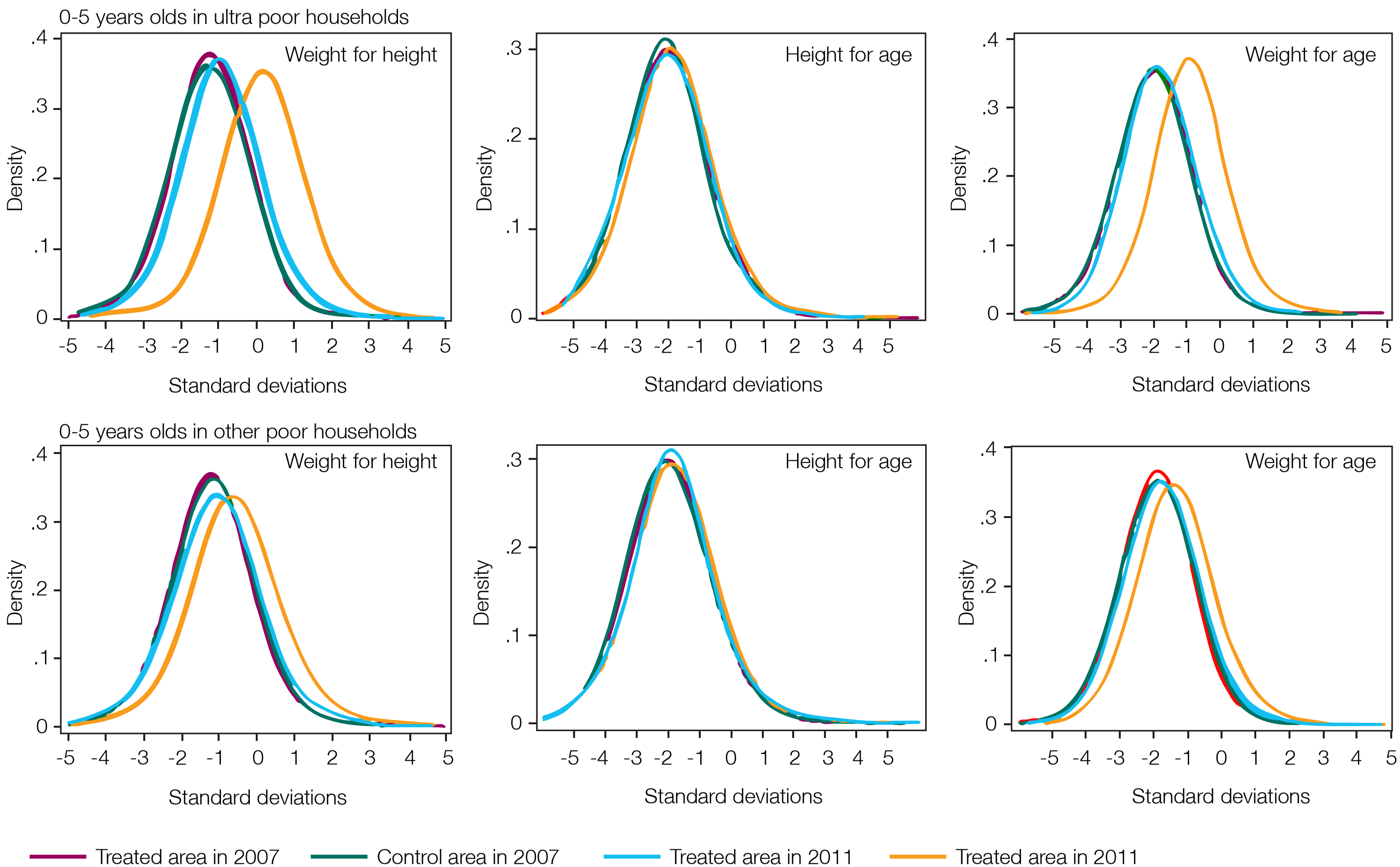
Table 2. Baseline summary statistics of outcome variables

	Ultra poor households			Other-poor households		
	Treated areas	Control areas	Normalised differences	Treated areas	Control areas	Normalised differences
	1	2	3	4	5	6
Panel A: 6 to 19 years						
Body mass index (BMI in SD)	-1.37	-1.35	-0.02	-1.34	-1.28	-0.06
Thinness (BMI <-2SD) (1/0)	0.26	0.24	0.03	0.24	0.22	0.04
Height for age (HAZ)	-1.63	-1.69	0.05	-1.53	-1.55	0.01
Stunting (HAZ <-2SD) (1/0)	0.39	0.40	-0.02	0.34	0.36	-0.03
Weight for age (WAZ)	-1.97	-1.99	0.02	-1.88	-1.89	0.02
Underweight (WAZ <-2SD) (1/0)	0.50	0.49	0.01	0.46	0.47	-0.01
Observations	3,620	2,098	-	5,103	5,707	-
Panel B: 19 years+						
Body mass index (absolute value)	18.26	18.40	-0.06	18.88	18.91	-0.01
Moderate thinnes (BMI <18.5)	0.60	0.56	0.07	0.49	0.48	0.01
Severe thinness (BMI <17)	0.29	0.28	0.03	0.20	0.20	0.02
Observations	6,415	4,027	-	8,459	9,638	-

Notes:
Table shows baseline (2007) means of outcome variables. Columns 1 and 2 show means across treated and control areas for ultra poor households. Columns 4 and 5 show outcome means across treated and control areas among other-poor households. Columns 4 and 6 present normalised differences between the respective groups, calculated as the difference in means in treatment and control areas, divided by the squared root of the sum of their variances.

The evaluation instrument collected detailed information related to demographic characteristics such as composition of the household, sex of the household head and the household size. Socioeconomic information detailed on education and employment status of all household members including sources of income with a recall period of 12 months. Detailed information on assets (land, livestock, and cash saving) were collected (see Annex A4). Comparison of baseline means show a higher probability of an UP household head working as a casual day labourer in treated areas than as control (46% versus 30%). None of the other characteristics were significantly different from each other. Similarly for OP households, none of the differences in the covariates significantly differed between treated and control areas.

Fig 1. Trends in anthropometric indicators for children under-5 years in ultra poor and other poor households across treated and control areas



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EMPIRICAL STRATEGY

ANALYTICAL TECHNIQUE

To identify impact of the programme on the ultra-poor, we compare trends in nutritional outcomes of ultra-poor individuals between treated and control communities. We estimate a difference-in-difference (DiD) model for each outcome Y_i to control for group-level compositional changes across treated and control areas. Using ordinary least squares for the sample of UP households, we calculate the DiD using the following functional form:

$$Y_{it} = \alpha + X'_{i0}\beta_1 + Y'_{i0}\beta_2 + \beta_3 D_{it} + \gamma_i + t_t + \varepsilon_{it} \text{ ....(1)}$$

X'_0 represents a vector of baseline household characteristics and Y'_0 represents baseline outcomes (Y'_0). Given the broad scope of CFPR, we prefer to control for baseline, rather than time varying characteristics as these could potentially be affected by the treatment. γ_i represents village level fixed effects[14] and t_t represents the time trend in nutritional status common to both groups. D_{it} is equal to one if the household is residing in a treated districtat time t. The coefficient of interest (β_3) represents the treatment effect of the CFPR. Spill-over effects are identified using the same specification (1), but estimated on the sample of OP/NP individuals. Standard errors are clustered at the branch level.

The women-centric application of the CFPR resulted in greater socioeconomic gains for female headed households during the first phase of the programme (Misha *et al*. 2014). On the other hand, gender based discrimination in favour of males, especially in terms of food consumption and in relation to children, are not uncommon in Bangladesh (WFP 2012). To investigate the gender related heterogeneity of the effects of CFPR on nutritional outcomes, we extend model (1) through the inclusion of two interaction terms:

14 We prefer using village fixed effects over individual fixed effects as the latter cannot be identified for those individuals 'outgrow' a specific age-group, or are born into the youngest group later on in the survey. We confirmed robustness of results to using household fixed effects and to using non-linear models. Results are available upon request.

$$Y_i = \alpha + X_{i0}'\theta_1 + Y_{i0}'\theta_2 + \theta_3 D_{it} + \theta_4 D_{it} * HH_{it} + \theta_5 D_{it} * Gen_{it} + \gamma_t + \varepsilon_{it} \text{ ....(2)}$$

where $HH_{it} = 1$ if the head of the household is male. Similarly, $Gen_{it} = 1$ if the individual is a male. In model (2), θ_3 gives the unique average effect of CFPR on a female respondent in a female headed households. The average effect on the treated is obtained though averaging the partial effect of CFPR across treated areas and subsequently combining θ_3 with θ_4 and θ_5. Similarly, the impact on individuals in female headed households (θ_4) is given by averaging the partial effect of CFPR in treated areas for the particular subgroup. Standard errors are estimated using the delta method and are clustered at the branch level.

To deal with Type 1 errors (α) due to multiple hypothesis testing, the critical value at which the null hypothesis is rejected are adjusted downward using the Bonferroni correction procedure (Gibson *et al.* 2011; Sankoh et al. 1997).[15] All analysis is done using STATA 13.

ATTRITION

The rate of attrition in our sample (16% and 17% for participant and non-participant household members respectively) is not uncommon for programmes such as the CFPR (Banerjee *et al*., 2010). Models investigating the correlates of attrition among both UP and OP households are presented in Annex A5. Generally we find limited correlation among the covariates with the likelihood of attrition. Household heads working in agriculture or as semi-skilled workers among UP households are less likely to attrite. Household heads with primary education among OP households are

15 Tables 2, 3 and 4 examine the impact and spill over effects of CFPR on multiple outcomes, giving rise to the possibility of Type I errors (α). Typical thresholds of α=0.05 equates to 1 in 20 null hypothesis being rejected by chance. The probability increases to 0.27 for 6 outcomes. We use Bonferroni correction procedures for multiple hypothesis testing following Gibson, McKenzie and Stillman (2011). The correction accounts for family-wise correlations between outcomes. For outcomes related to ages 0 to 19 years, the correlation is 0.13 and 0.23 for adult (19+ years) outcomes. Although the Bonferroni procedure is considered quite conservative for correlated outcomes, our results are robust to the correction (McKenzie 2012; Perneger 1998). Factoring in family-wise correlations in the calculations yields the following set of critical values:

Critical threshold (α)	Bonferroni corrected critical threshold (α_B)	
	0-19yrs	19+ years
0.100	0.021	0.046
0.050	0.011	0.023
0.010	0.002	0.005

similarly less likely to attrite.We subsequently test whether the relationship between the covariates and attrition vary across the treatment status. The null hypotheses of this test was not rejected. Attrition could bias our impact estimates if it is related to unobservable time varying variables that also correlate with treatment.To test for attrition bias we utilise the Verbeek and Neijman (1992) test where we add a leading selection indicator to the DiD model (1) and test the significance of this indicator (Jones *et al*. 2013). Results indicate the attrition to be random as the null of no effect was not rejected for any of the outcomes (results available upon request).

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RESULTS

IMPACT OF CFPR ON PARTICIPANT HOUSEHOLDS

Table 3 presents the average treatment effect on UP households. The estimates are subsequently disaggregated to show the heterogeneity of impact across the sex of the household head and subsequently across the gender of each of the members.

Panel A presents the impact of the CFPR on under-5 children. The weight-for-height z-scores in children increase by 0.78 SD and represents nearly 60% change over the baseline mean. This correspondingly precipitates the reduction in the probability of wasting (WHZ <-2SD) by 8 percentage points (pp). Children in treated areas experience an increase of 0.52 SD in the weight-for-age indicator (25% increase from baseline) with a corresponding reduction in the likelihood of being underweight (WHZ <-2SD) by 19 pp. No impact is seen in the height-for-age indicator or the probability of stunting. Results investigating the heterogeneity of impact show greater reduction in the probability of being underweight in female headed households. The impact of CFPR does not vary by the sex of the individual.

Panel B presents impact of CFPR on the nutritional status of individuals aged 6 to 19 years. The BMI among individuals in this age group increase by 0.36 SD (27% over the baseline) with an 11 pp reduction in the likelihood of being thin. Though the weight-for-age does not increase significantly, the probability of being underweight (WAZ <-2SD) reduces by 10 pp. Height-for-age or the likelihood of stunting (HAZ <-2SD) are not affected by CFPR participation. Heterogeneity of effects confirm that individuals in female headed households experience a greater reduction in the probability of thinness.

Impact on individuals aged above 19 years are presented in Panel C. Results show that the BMI among adults in treated communities increases by 0.57. The probability of being moderately thin (BMI <18.5) reduces by 11pp and the likelihood of being severely thin (BMI <17.0) by 8pp. Heterogeneity in impact reveal greater gains in BMI among men. Similarly, adults living in male headed households are more likely to experience larger reduction in the probability of moderate thinness. We subsequently test whether women are impacted differently across male or female headed households. Results reveal no significant differences (results available upon request).

Table 3: Impact of CFPR on nutritional status of ultra poor households

	Main impact		Heterogeneity of impact							
			Male headed households		Female headed households		Female		Male	
	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors
Panel A: 0 to 5 years										
Weight for height (WHZ)	0.781***	0.112	0.764***	0.123	0.894***	0.242	0.703***	0.119	0.856***	0.144
Wasting (WHZ<-2SD) (1/0)	-0.079*	0.041	-0.074	0.043	-0.107	0.070	-0.066	0.047	-0.090*	0.043
Height for age (HAZ)	0.096	0.180	0.067	0.180	0.291	0.320	-0.059	0.187	0.247	0.194
Stunting (HAZ<-2SD) (1/0)	-0.049	0.064	-0.029	0.065	-0.186	0.090	-0.044	0.066	-0.053	0.071
Weight for age (WAZ)	0.520***	0.107	0.487***	0.110	0.742***	0.162	0.431***	0.120	0.607***	0.119
Underweight (WAZ<-2SD) (1/0)	-0.191***	0.039	-0.204***	0.041	-0.099	0.076	-0.162***	0.044	-0.219***	0.046
Observations	3,420		2,975		443		1,689		1,729	
Panel B: 6 to 19 years										
Body mass index (BMI in SD)	0.362***	0.054	0.342***	0.056	0.429***	0.072	0.396***	0.059	0.333***	0.062
Thinness (BMI< -2SD) (1/0)	-0.114***	0.022	-0.098***	0.022	-0.169***	0.030	-0.115***	0.023	-0.114***	0.026
Height for age (HAZ)	0.009	0.091	-0.015	0.097	0.093	0.103	-0.065	0.106	0.074	0.086
Stunting (HAZ<-2SD) (1/0)	-0.018	0.027	-0.018	0.029	-0.019	0.036	0.005	0.036	-0.038	0.026
Weight for age (WAZ)	0.176	0.097	0.139	0.100	0.307	0.160	0.220	0.113	0.140	0.105
Underweight (WAZ<-2SD) (1/0)	-0.104***	0.038	-0.104*	0.041	-0.105	0.064	-0.138***	0.039	-0.076	0.048
Observations	4,946		3,824		1,122		2,295		2,651	

	Main impact		Heterogeneity of impact							
			Male headed households		Female headed households		Female		Male	
	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors
Panel C: 19 years +										
Body mass index (absolute value)	0.566***	0.077	0.585***	0.083	0.529***	0.092	0.608***	0.077	0.442***	0.090
Moderate thinness (BMI<18.5)	-0.109***	0.014	-0.119***	0.015	-0.091***	0.015	-0.110***	0.013	-0.106***	0.020
Severe thinness (BMI<17)	-0.076***	0.012	-0.071***	0.011	-0.085***	0.016	-0.080***	0.011	-0.064***	0.019
Observations	17,895		11,840		6,055		13,420		4,475	

Notes:
Table shows marginal effects of OLS models using villagelevel fixed effects.For ages 0 through 19, effecton the continuous z-scores should be interpreted in terms of standard deviations from the median of the WHO international reference group. Results for the group 20+ years show absolute values of BMI and binary outcomes (BMI<18.5 and BMI<17.5) indicating moderate and severe thinness. Errors are calculated using the delta method and clustered at the branch level. Critical values at which the null hypothesis is rejected is adjusted down using the Bonferroni correction.

***, **,* indicate significance at the 10%, 5% and 1% respectively. Bold indicates significant difference between male and female headed households; and between male and female respondents at the 10% level.

Overall, considerable effects are seen for individuals living in participating households, the results most pronounced among the children under-5.

SPILLOVER EFFECTS OF CFPR

The spill over of effects of CFPR on OP households are presented in Table 4. The weight-for-height z-scores for children under-5 increase by 0.45 SD, resulting in a 12 pp drop in the probability of being wasted. While the magnitude of impact on the continuous indicator is nearly half in comparison to the impact on the ultra-poor, the magnitude of the effect on the variable indicating wasting is in fact larger than the ATET (12 pp versus 8 pp).The weight-for-height indicators increases by 0.28 SD (compared to 0.52 SD for the UP). This results in the reduction in probability of being underweight by 9 pp in comparison to 19 pp among the UP. Impact on height-for-age or the probability of stunting is not significantly different from 0. Heterogeneity of effects across the sex of the household head show the effects on the weight-for-height indicator to be more than four times greater among the female headed households. Similar results are found for the probability of wasting. Furthermore, the z-score for weight-for-height among female children increase nearly twice as much. Similar trends are also noticed for the weight-for-age indicator.

Effects are smaller for the 6-19 years age group (Panel B). The z-score for BMI increases for this population by 0.19 SD and the probability of being thin reduces by 4 pp. The magnitudes of these effects are nearly half of the impact for the UP (0.36 SD and 11 pp respectively). No impact is seen for the height-for-age or the weight-for-age indicators. While no heterogeneity is detected across the sex of the household head, gains in BMI among female members are significantly higher.

Panel C shows the impact on adults older than 19 years. The BMI among adults increase by 0.23 (roughly a third of the impact on UP households). The correspondent likelihood of being moderately thin (BMI <18.5) reduces by 4 pp and the probability of severe thinness diminishes by 3 pp (corresponding figures for participant adults are 11 pp and 8 pp respectively). While no heterogeneity of effects are apparent across the sex of the household head, the BMI among the female members are three times their male counterparts.The likelihood of severe thinness decreases considerably more for the women.

No impact of CFPR is seen among members of NP households (see Annex A6). Overall, significant improvements are seen in the nutritional status among the OP, the size of the magnitudes being typically half of those for the participants.

Table 4. Spillover effects of CFPR on nutritional status on other poor households

	Main impact		Heterogeneity of impact							
			Male headed households		Female headed households		Female		Male	
	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors
Panel A: 0 to 5 years										
Weight for height (WHZ)	0.452***	0.111	0.421***	0.107	1.321***	0.306	0.561***	0.128	0.341**	0.121
Wasting (WHZ<-2SD) (1/0)	-0.119***	0.032	-0.108***	0.032	-0.428***	0.140	-0.140***	0.037	-0.097**	0.037
Height for age (HAZ)	0.057	0.127	0.077	0.124	-0.524	0.410	0.128	0.148	-0.016	0.148
Stunting (HAZ<-2SD) (1/0)	-0.019	0.043	-0.021	0.041	0.019	0.186	-0.051	0.062	0.012	0.040
Weight for age (WAZ)	0.282***	0.058	0.273***	0.059	0.524	0.269	0.353***	0.064	0.210***	0.065
Underweight (WAZ<-2SD) (1/0)	-0.086***	0.029	-0.089***	0.028	-0.012	0.175	-0.030	0.032	-0.142***	0.035
Observations	6,583		6,355		228		3,263		3,320	
Panel B: 6 to 19 years										
Body mass index (BMI in SD)	0.189***	0.050	0.182***	0.050	0.295***	0.097	0.241***	0.059	0.141*	0.057
Thinness (BMI< -2SD) (1/0)	-0.042*	0.018	-0.043*	0.018	-0.041	0.040	-0.031	0.021	-0.053*	0.022
Height for age (HAZ)	-0.022	0.075	-0.021	0.077	-0.044	0.135	-0.051	0.072	0.004	0.095
Stunting (HAZ<-2SD) (1/0)	0.021	0.025	0.023	0.024	-0.001	0.050	0.011	0.029	0.031	0.028
Weight for age (WAZ)	0.045	0.089	0.035	0.091	0.205	0.166	0.031	0.076	0.058	0.119
Underweight (WAZ<-2SD) (1/0)	-0.017	0.042	-0.021	0.042	0.037	0.094	-0.005	0.035	-0.029	0.057
Observations	8,957		8,396		561		4,333		4,624	

	Main impact		Heterogeneity of impact							
			Male headed households		Female headed households		Female		Male	
	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors
Panel C: 19 years +										
Body mass index (absolute value)	0.227***	0.066	0.234***	0.068	0.179	0.089	0.297***	0.067	0.082	0.081
Moderate thinness (BMI<18.5)	-0.036***	0.012	-0.038***	0.012	-0.026	0.016	-0.037***	0.012	-0.035	0.017
Severe thinness (BMI<17)	-0.025***	0.007	-0.025***	0.007	-0.027	0.015	-0.029***	0.007	-0.018*	0.008
Observations		30,803		26,900		3,903		20,691		10,112

Notes:
Table shows marginal effects of OLS models using village level fixed effects. For ages 0 through 19, effect on the continuous z-scores should be interpreted in terms of standard deviations from the median of the WHO international reference group. Results for the group 20+ years show absolute values of BMI and binary outcomes (BMI<18.5 and BMI<17.5) indicating moderate and severe thinness. Errors are calculated using the delta method and clustered at the branch level. Critical values at which the null hypothesis is rejected is adjusted down using the Bonferroni correction. ***,**,* indicate significance at 10%, 5% and 1% respectively. Bold indicates significant difference between male and female headed households; and between male and female respondents at the 10% level.

PATHWAYS OF SPILLOVER EFFECT IN NON-PARTICIPANT CHILDREN

We use the UNICEF nutrition framework (1990) to identify potential avenues for spill-over effects. The framework identifies factors such as the increased likelihood and duration of exclusive breastfeeding, diminished exposure to infectious diseases and access to vitamin A supplements as contributing to better nutritional outcomes among children. At baseline, proportion of mothers who breastfeed are nearly universal (see Annex A2). Among the UP, more than 95% of the mothers in treated areas breastfeed their children compared to 97% in control. The duration of exclusive breastfeeding among the UP in treated and control areas are 103 days and 94 days respectively. While 28% of the mothers administered vitamin A to their children after birth in treated areas, the proportion among the control is 34%. The prevalence of breastfeeding and the duration are comparable in OP households, the proportions of children who receive vitamin A are 38% and 34% in the treated and control areas respectively. Lastly, the prevalence of children under-5 with infectious diseases is 3% for both UP and OP households in both treated and control areas.

The framework similarly identifies illnesses, lack of food security and poor public health conditions (e.g. access to sanitary latrines) as detrimental to adult nutritional status. At baseline, the likelihood of an illness averages at around 27% and 26% among the UP and OP respectively. While 47% of UP in treated areas can typically manage 2 meals a day, their counterparts average at 36%. Approximately 66% of OP in treated areas can manage two meals day, the average among those in the control areas is 57%. Nearly 55% of households in treated areas use sanitary latrines compared to 47% among the control. Use of sanitary latrines among the OP is 65% and 60% respectively for treated and control areas. Access to safe drinking water however is nearly universal across all groups.

Table 5 shows the impact of CFPR on intermediary outcomes affecting the nutrition status of members in both UP and OP households. Considering the high prevalence of breastfeeding during the baseline, the lack of impact is not surprising. The impact on the duration of exclusive breastfeeding is large. CFPR causes mothers in ultra-poor households to increase the duration of exclusive breastfeeding by 73 days (75% increase over the baseline), while the spill over effect to other-poor is 52 days (49% increase over the baseline). Similarly, the probability of a child receiving a vitamin A supplement increases by 26 pp and 20 pp among UP and OP households respectively.

If the duration of breastfeeding is an important pathway of the nutritional impact of CFPR, we should see larger effects of CFPR on children under 24 months. We investigate the heterogeneity of impact across two age groups: 0-24 months and 25-60 months (see Annex A7) and find that indeed underweight weight-for-height and probability of being underweight are more strongly affected for the younger group (0-24 months) among both the UP and OP households. The differences in the magnitudes of impact for the ultra-poor and other-poor households are comparable to the main findings.

Table 5. Impact on intermediary outcomes

	Ultra-poor households		Other-poor households	
	Marginal Effects	Standard Error	Marginal Effects	Standard Error
Breastfeeding and vitamin A supplements				
Probability of breastfeeding (1/0)	0.012	0.013	0.018	0.011
Duration of exclusive breastfeeding (days)	72.681***	0.025	59.521***	0.080
Administration of Vitamin A (1/0)	0.264***	0.069	0.196**	0.080
Observations	2,300		4,894	
Illnesses				
Likelihood of contracting an infectious disease (children) (1/0)	-0.052	0.048	-0.005	0.030
Observations	1,363		2,714	
Likelihood of falling ill (adults) (1/0)	-0.020*	0.006	-0.006	0.004
Observations	21,841		36,760	
Food security				
Members can generally manage two meals a day (1/0)	0.143**	0.059	0.061*	0.030
Observations	4,296		8,896	
Safe water and hygiene practices				
Use of sanitary toilet (1/0)	0.179***	0.055	0.108**	0.049
Safe drinking water (1/0)	-0.005	0.008	-0.011	0.008
Observations	4,296		8,896	

Notes:
Table shows marginal effects of OLS models using village level fixed effects. Results represent the impact of CFPR on intermediary outcomes that may affect nutritional status in ultra-poor and other-poor households and the sample is restricted to households with children under 5. Standard errors clustered at the branch level. ***,**,* indicate significance at 10%, 5% and 1% respectively.

Adults among ultra-poor households are less likely to fall ill by 2pp, though no impact is seen among the other-poor adults. In terms of food security however, both groups experience an increase in the probability of generally being able to secure at least two meals every day (by 14pp and 6pp for the ultra-poor and other-poor respectively). Lastly, the use of sanitary toilets increases by 18pp and 11pp respectively for the ultra-poor and other-poor respectively.

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DISCUSSION AND CONCLUDING REMARKS

Challenging the Frontiers of Poverty Reduction (CFPR) was implemented by a NGO called BRAC with the target of alleviating ultra-poverty in Bangladesh. The CFPR provides income generating and multifaceted training in entrepreneurial activities, health and nutrition, social and legal awareness to its participants over a period of two years. Utilising the randomised roll out of the programme, this paper uses a two round panel data across four years to first identify the impact of CFPR on the nutritional status among the ultra poor (UP) participant households. Second, we estimate the spill-over effects of the programme on other poor (OP) and non-poor (NP) households. Heterogeneity of impact is measured across male and female headed households followed by the sex of the respondent. Lastly, through the measurement of intermediary outcomes that affect the nutritional status, we analyse pathways through which the impact and spill-over effects take place.

We find considerable impact on the nutritional status among UP household members, most pronounced for children under-5. In addition to improvements in the weight-for-height and weight-for-age indicators, the likelihood of wasting and being underweight reduces by 8pp and 19pp respectively. Among 6-19 years age group, the likelihood of thinness drops by 4pp, followed by a 10pp reduction in the probability of being underweight. While gains are generally higher among individuals in female headed households, we find no differences in impact across gender of the specific individual. Nutritional status among adults in ultra poor households similarly gain from CFPR, leading to decreases in the likelihood of moderate and severe thinness (by 11pp and 8pp respectively).

We find that the CFPR generates spill-over effects among non-participating households in treatment areas, the benefits however, restricted to other poor households as opposed to the non-poor. The magnitudes of the impacts on OP are generally half of the UP households and are typically most pronounced for children. We find that the likelihood of wasting or being underweight reduce by 12pp and 9pp respectively for children in this group. The probability of thinness reduces by 4pp among the 6-19 year olds. In line with findings from the ultra poor, individuals in female headed households gain the most. While the gains in nutritional status among children under-5 are more favourable towards females, males aged 6-19 years fare better. Other-poor adults (19+ years) on average experience a 4pp and 3pp drop in the likelihood of being moderately and severely thin.

Analysis of the pathways provides important insights. Results indicate that increased durations of exclusive breastfeeding and vitamin A supplements among both the ultra poor and other poor. For adolescents and adults in ultra poor households, several factors contribute to the improved nutritional status. In addition to the rise in income as noted by Bandiera *et al.* (2013), we find evidence of improved food security, lower likelihood of falling ill and improved hygiene practices. For the other-poor, results show improved food security and improved hygiene practices. While the rise in income for this group is small in magnitude (Bandiera *et al.* 2013), Angelucci *et al.* (2006), studying the spill-over effects of a cash transfer programme (PROGRESA) on the nutritional status of non-participants, offer an alternative explanation as to how this takes place. They state that despite the nominal rise in income among non-participants, the consumption among these households increase considerably more. Due to the liquidity injection among the participants, the non-participants receive more transfers and can borrow more when hit by a negative shock, thereby reducing their precautionary savings to increase current consumption.

There are some limitations to this study. Given the lack of birth registration practices, especially among lower socioeconomic groups, we use approximate ages (in nearest months) when calculating the z-scores used in the models. Pathways of impact and spill-over effects measured in this paper are not comprehensive. There may be other unaccounted ways through which these effects occur and merit further research. Notwithstanding these limitations, several important points emerge from our analysis. We find that the CFPR not only has considerable impact on the nutritional status of its participants, but also creates positive spill-over effects among non-participants. The magnitude of impact on the non-participants in treated areas is typically half of the impact on participants. In line with previous literature showing that women in charge of allocating productive and financial assets of a family are likely to garner greater positive change, we find individuals in female headed households fare better (Baden and Milward 1995). The fact that there is limited indication of gender differentials in impact in an important finding. Gender based discrimination biased towards males, especially for children is not uncommon in Bangladesh (WFP 2012). The results may be indicative of the success of a large number social awareness programmes, including CFPR, working to reverse these trends (Kabeer *et al.* 2013). Lastly, the impact and spill-over effects, especially among infants (through increased durations of exclusive breastfeeding), are driven by behavioural changes, without financial incentives. This shows that unlike other nutrition oriented programmes that typically adopt a one-off push[16], repeated exposure to CFPR over a two year period

16 The Gates Foundation funded programme Alive and Thrive for example aims to improve infant and child feeding practices in Bangladesh through increasing the rates of exclusive breastfeeding and complementary feeding practices. Evaluation of the large scale programme reported that while the programme was able to induce earlier breastfeeding practices, the duration of exclusive feeding remained unaffected (Saha KK, Bamezai A, Khaled A, Subandoro A, Rawat R 2008). A number of studies on the other hand report the absence or even negative effects of food subsidy programmes on nutrition (Jensen and Miller, 2011, 2008; Shankar Shaw and Telidevara, 2014).

is likely to have played a key role in instilling the messages among the participants, ultimately leading to behavioural changes. Similar exposure and longer periods of "demonstration effects" play a large role in precipitating similar changes among the other-poor households in the treated communities.

Overall, in spite of accounting for actual impact and spill-over effects, longer term impact of CFPR may be underestimated, especially for children. In the short run, resources typically dedicated to dealing with illnesses brought on by increased vulnerabilities will likely be allocated to more fruitful avenues. Increased cognitive acumen through improved nutrition will increase performance in productive activities. Longer term impact as adults will likely lead to higher professional productivity and financial gains.

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ANNEXURES

Annex A1. Baseline summary of outcome variables for children under-5 years

	Ultra poor households			Other poor households		
	Treated areas	Control areas	Normalised differences	Treated areas	Control areas	Normalised differences
	1	2	3	4	5	6
Panel A: 0 to 5 years						
Weight for height z-score (WHZ)	-1.20	-1.25	0.05	-1.17	-1.13	-0.03
Wasting (WHZ <-2SD) (1/0)	0.20	0.23	-0.07	0.21	0.18	0.06
Height for age z-score (HAZ)	-2.01	-2.02	0.01	-1.92	-1.95	0.03
Stunting (HAZ <-2SD) (1/0)	0.51	0.52	-0.01	0.48	0.50	-0.04
Weight for age z-score (WAZ)	-1.98	-2.02	0.04	-1.92	-1.89	-0.03
Underweight (WAZ <-2SD) (1/0)	0.48	0.50	-0.04	0.47	0.46	0.01
Observations	1,900	1,075		2,700	2,998	

Notes:
Table shows baseline (2007) means of outcome variables. Columns 1 and 2 show means across treated and control areas for ultra-poor households. Columns 4 and 5 show outcome means across treated and control areas among other-poor households. Columns 4 and 6 present normalised differences between the respective groups, calculated as the difference in means in treatment and control areas, divided by the squared root of the sum of their variances.

Annex A2. Baseline summary of intermediary variables

	Ultra poor households			Other poor households		
	Treated areas	Control areas	Normalised differences	Treated areas	Control areas	Normalised differences
	1	2	4	5	6	8
Breastfeeding and vitamin A supplements[¥]						
Probability of breastfeeding (1/0)	0.97	0.97	0.02	0.98	0.97	0.04
Duration of exclusive breastfeeding (days)	103	94	0.10	105	99	0.08
Administration of Vitamin A (1/0)	0.28	0.34	0.13	0.38	0.34	0.09
Observations	1032	548		1541	1774	
Illnesses[¥]						
Likelihood of contracting an infectious disease (children) (1/0)	0.03	0.03	0.01	0.03	0.03	0.02
Observations	4071	2551		5194	6044	
Likelihood of falling ill (adults) (1/0)	0.278	0.29	0.030	0.254	0.261	0.017
Observations	14624	8783		20448	23127	
Food security[†]						
Members can generally manage two meals a day (1/0)	0.467	0.364	0.220	0.657	0.566	0.180
Observations	4440	2875		5382	6227	
Safe water and hygiene practices[†]						
Use of sanitary toilet (1/0)	0.55	0.47	0.17	0.65	0.60	0.11
Safe drinking water (1/0)	0.99	0.99	0.07	0.98	0.99	0.09
Observations	4440	2875		5382	6227	

Notes:
Table shows baseline (2007) means of intermediary variables. Columns 1 and 2 show means across treated and control areas for ultra poor households. Columns 4 and 5 show outcome means across treated and control areas among other-poor households. Columns 4 and 6 present normalised differences between the respective groups, calculated as the difference in means in treatment and control areas, divided by the squared root of the sum of their variances. Normalised differences greater than 0.25 indicates statistically different means.[¥] Analysis conducted at the individual level.[†] Analysis conducted at the household level.

Annex A3. End-line summary of outcomes

	Ultra poor			Other Poor		
	Treated areas	Control areas	Normalised differences	Treated areas	Control ares	Normalised differences
	1	2	3	4	5	6
Panel B: 6 to 19 years						
Body mass index (BMI in SD)	-0.90	-1.27	35.00	-1.06	-1.23	16.30
Thinness (BMI< -2SD) (1/0)	0.13	0.23	-25.40	0.17	0.22	-12.70
Height for age (HAZ)	-1.81	-1.85	3.30	-1.69	-1.67	-1.60
Stunting (HAZ <-2SD) (1/0)	0.44	0.47	-4.20	0.40	0.40	0.60
Weight for age (WAZ)	-1.73	-2.15	38.50	-1.84	-1.98	12.50
Underweight (WAZ<-2SD) (1/0)	0.39	0.58	-38.90	0.43	0.49	-10.70
Observations	3220	2016		4853	5330	
Panel C: 19 years +						
Body mass index (absolute value)	19.51	19.04	17.20	19.91	19.69	7.80
Moderate thinness (BMI<18.5)	0.38	0.47	-17.40	0.33	0.36	-6.00
Severe thinness (BMI<17)	0.15	0.22	-17.50	0.12	0.14	-6.50
Observations	5,806	3,693		7,835	8,947	

Notes:

Table shows end-line (2011) means of outcome variables. Columns 1 and 2 show means across treated and control areas for ultra poor households. Columns 4 and 5 show outcome means across treated and control areas among other poor households. Columns 4 and 6 present normalized differences between the respective groups, calculated as the difference in means in treatment and control areas, divided by the squared root of the sum of their variances.

Annex A4. Baseline summary of control variables

	Ultra poor households			Other poor households		
	Treated areas	Control areas	Normalised differences	Treated areas	Control areas	Normalised differences
	1	2	3	4	5	6
Demographics						
Female headed household (1/0)	0.23	0.32	-0.19	0.08	0.09	-0.02
Household size	4.15	4.07	0.07	4.52	4.46	0.03
Socioeconomics						
Per capita income (BDT)	5170	6477	-0.13	3256	3765	-0.05
Standard deviation						
Education of household head:						
No education (1/0)	0.73	0.77	-0.09	0.60	0.60	0.00
Primary education (1/0)	0.22	0.18	0.09	0.29	0.28	0.01
Secondary education (1/0)	0.04	0.03	0.02	0.09	0.09	-0.01
Tertiary education (1/0)	0.01	0.01	-0.01	0.03	0.04	-0.03
Employment of household head						
Household work (1/0)	0.12	0.14	-0.06	0.04	0.06	-0.06
Casual day labourer (1/0)	0.46	0.30	0.34	0.64	0.59	0.10
Agricultural worker (1/0)	0.37	0.48	-0.24	0.26	0.29	-0.08
Semi-skilled worker (1/0)	0.03	0.04	-0.06	0.04	0.04	0.02
Other employment (1/0)	0.03	0.04	-0.09	0.02	0.03	0.03

	Ultra poor households			Other poor households		
	Treated areas	Control areas	Normalised differences	Treated areas	Control areas	Normalised differences
	1	2	3	4	5	6
Asset						
Owns any land (1/0)	0.08	0.07	0.02	0.21	0.18	0.05
Owns any livestock (1/0)	0.53	0.50	0.06	0.71	0.70	0.00
Has any savings (1/0)	0.38	0.36	0.06	0.58	0.58	0.02
Observations	14,624	8,793		20,448	23,127	

Notes:

Table shows baseline (2007) means of control variables. Columns 1 and 2 show means across treated and control areas for ultra poor households. Columns 4 and 5 show outcome means across treated and control areas among other-poor households. Columns 4 and 6 present normalised differences between the respective groups, calculated as the difference in means in treatment and control areas, divided by the squared root of the sum of their variances. Normalised differences greater than 0.25 indicates statistically different means.

Annex A5. Determinants of attrition

	Ultra poor Households		Other poor Households	
	Marginal Effects	Standard errors	Marginal Effects	Standard errors
Ultra poor households (1/0)	0.009	0.017	-	-
Other-poor households (1/0)	-	-	0.005	0.017
Nutrition indicators				
Height (in cm)	0.000	0.000	0.000	0.000
Weight (in kg)	0.000	0.000	0.000	0.000
Age (in months)	-0.001	0.000	0.000	0.000
Demographics				
Female headed household (1/0)	0.011	0.012	0.021	0.015
Household size	-0.005	0.003	0.000	0.002
Socioeconomics				
Per capita income (BDT)	0.000	0.000	0.000	0.000
Education of household head:				
Primary education (1/0)	-0.022	0.014	-0.030***	0.010
Secondary education (1/0)	0.003	0.028	0.013	0.013
Tertiary education (1/0)	-0.083	0.044	0.013	0.020
Employment of household head:				
Casual day labourer (1/0)	-0.053	0.017	-0.034	0.019
Agricultural worker (1/0)	-0.067***	0.017	-0.088	0.016
Semi-skilled worker (1/0)	-0.080**	0.028	-0.068**	0.025
Other employment (1/0)	0.000	0.024	-0.026	0.012
Asset				
Owns any land (1/0)	-0.012	0.010	-0.006	0.008
Owns any livestock (1/0)	-0.012	0.011	-0.011	0.012
Observations	20,357		37,192	

Notes:
Table shows marginal effects of a probit model. The dependent variable, attrition, is equal to 1 if the individual is not observed in 2011 and 0 otherwise. The models are analysed using village level fixed effects and the standard errors are clustered at the branch level. The null hypothesis of whether the covariates and attrition vary across the treatment status was not rejected.

Annex A6. Spillover effects of CFPR on nutritional status of non-poor households

	Marginal Effects	Standard errors
Panel A: 0 to 5 years		
Weight for height (WHZ)	-0.081	0.089
Wasting (WHZ<-2SD) (1/0)	0.046	0.028
Height for age (HAZ)	0.098	0.137
Stunting (HAZ<-2SD) (1/0)	-0.050	0.045
Weight for age (WAZ)	0.039	0.090
Underweight (WAZ<-2SD) (1/0)	-0.017	0.044
Observations	3,124	
Panel B: 6 to 19 years		
Body mass index (BMI in SD)	-0.017	0.066
Thinness (BMI< -2SD) (1/0)	0.029	0.021
Height for age (HAZ)	-0.063	0.081
Stunting (HAZ<-2SD) (1/0)	-0.002	0.029
Weight for age (WAZ)	0.002	0.119
Underweight (WAZ<-2SD) (1/0)	-0.000	0.072
Observations	4,625	
Panel C: 19 years +		
Body mass index (absolute value)	-0.009	0.075
Moderate thinness (BMI<18.5)	0.003	0.012
Severe thinness (BMI<17)	0.002	0.007
Observations	20,489	

Notes:

Table shows marginal effects of OLS models using village level fixed effects. For ages 0 through 19, effect on the continuous z-scores should be interpreted in terms of standard deviations from the median of the WHO international reference group. Results for the group 20+ years show absolute values of BMI and binary outcomes (BMI<18.5 and BMI<17.5) indicating moderate and severe thinness. Errors are calculated using the delta method and clustered at the branch level. Critical values at which the null hypothesis is rejected is adjusted down using the Bonferroni correction. ***, **, * indicate significance at 10%, 5% and 1% per cent respectively. Bold indicates significant difference between male and female headed households; and between male and female respondents at the 10% level.

Annex A7. Comparison of impact between infants (0-24months) and toddlers (26-60 months)

	Ultra poor households				Other poor households			
	0-24 months		25-60 months		0-24 months		25-60 months	
Variables	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors	Marginal Effects	Standard errors
Weight for height (WHZ)	1.750***	0.132	1.024***	0.096	0.803***	0.653	0.411***	0.108
Wasting (WHZ<-2SD) (1/0)	-0.140***	0.033	-0.110***	0.023	-0.058	0.142	-0.084**	0.027
Height for age (HAZ)	0.422	0.879	0.187	0.153	0.979	1.281	0.216	0.140
Stunting (HAZ<-2SD) (1/0)	0.274	0.313	-0.074	0.052	0.129	0.220	-0.053	0.036
Weight for age (WAZ)	1.497***	0.430	0.746***	0.081	1.003**	0.316	0.336***	0.065
Underweight (WAZ<-2SD) (1/0)	-0.330***	0.058	-0.304***	0.041	-0.326***	0.040	-0.122***	0.026
Observations		840		2744		1760		5270

Notes:
Table shows marginal effects of OLS models using village level fixed effects. Effectson the continuous z-scores should be interpreted in terms of standard deviations from the median of the WHO international reference group.Bold indicates significant difference between the two age groups at the 10% level. Errors are calculated using the delta method and clustered at the branch level. Critical values at which the null hypothesis is rejected is adjusted down using the Bonferroni correction.

***, **, * indicate significance at 10%, 5% and 1% per cent respectively. Bold indicates significant difference between male and female headed households; and between male and female respondents at the 10% level.

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The authors

Wameq Raza is a health economist with a focus on impact evaluation. After completing his masters in Development Economics, Wameq joined the Research and Evaluation Division of BRAC as a development economist in 2008. He subsequently enrolled in a PhD programme in Health Economics at the Institute of Health Policy and Management at the Erasmus University Rotterdam in 2012. His thesis focused on the first ever experimental evaluation of a community based health insurance scheme in the Uttar Pradesh and Bihar states of India. Wameq is set to join the Research division of BRAC International in March 2016 based in Kampala, Uganda.

Ellen van de Poel after obtaining her PhD in 2009 from the Erasmus School of Economics, has been affiliated with the Institute of Health Policy and Management of Erasmus University Rotterdam as an associate professor. Her research focuses on applications of econometrics to problems of health and healthcare in low and middle income countries. More specifically, she is currently involved in two EU-FP7 projects that are both aimed at evaluating the impact of health financing reforms on access to care and financial protection in countries in Asia, and is working on her Veni project "Healthcare inequities in low and middle income countries: Measurement and explanation'. Ellen is also coordinator of the Global Health Track in the Master Health Economics, Policy and Law and teaching the course Global Health Economics. Since 2014, Ellen van de Poel represents the Board of Young Erasmus along with Liesbeth van Rossum.

BRAC
BRAC Centre
75 Mohakhali
Dhaka 1212
Bangladesh

T: 88 02 9881265
F: 88 02 8823542
E: altamas.p@brac.net
W: www.research.brac.net